|  |  |
| --- | --- |
| **Course Name**  *Penn Cambria Curriculum* | **Ecology/Zoology** |
| **Length of Course** | *1 Semester* |
| **Grade Level** | *All* |
| **Prerequisites** | *None* |
| **Course Description** | *Ecology/Zoology is an elective course designed to provide students with an overview of current environmental issues and their relationship to science and technology. The effects of humans on the environment will be emphasized. Selected topics include wildlife management, forestry, soil conservation, water quality monitoring, integrated pest management, watersheds, wetlands, pollution, natural resources, waste management, energy resources, and biodiversity. The course will also include a study of specific animals and their interrelationships with other living and nonliving components of the environment.* |
| **Units of Study** | *Watershed and Wetlands*  *Renewable and Nonrenewable Resources*  *Environmental Health*  *Integrated Pest Management*  *Ecosystems and Their Interactions*  *Population Dynamics*  *Threatened, Endangered, and Extinct Species*  *Humans and the Environment*  *Environmental Laws and Regulations*  *Zoology* |
| **Materials** | *Text: Environment and Ecology for Pennsylvania: Meeting the Standards. Globe Fearon, 2003*  *Supplemental Materials: Wildlife Notes. PA Game Commission* |

**Unit 1: Watersheds and Wetlands**

**Estimated Time:** 2.5 - 3 weeks

**Standard Alignment:**

3.1.12B – Apply concepts of models as a method to predict and understand science and technology.

3.1.12E – Evaluate change in nature, physical systems and man made systems.

4.1.12A – Categorize stream order in a wetland.

4.1.12B – Explain the relationships that exist within watersheds in the United States.

4.1.12C – Analyze the parameters of a watershed.

4.1.12D – Analyze the complex and diverse ecosystems of wetlands.

4.1.12E – Evaluate the trade-offs, costs and benefits of conserving watersheds and wetlands.

**Curricular Objectives:**

A. Explain the relationship among landforms, vegetation, and the amount of water speed

B. Describe the natural processes and human activities that affect the quality of groundwater.

C. Analyze the physical characteristics of a stream.

D. Describe how topography influences stream drainage patterns

E. Explain the influence of mountains on precipitation.

F. Describe the changes that occur from a stream's origin to its final outflow

G. Describe changes in a river from its source to its mouth.

H. Categorize stream orders in watersheds.

I. Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments.

J. Identify and categorize the terrestrial and aquatic organisms that live in a wetland.

K. Describe and explain the abiotic factors that affect a stream and the organisms living there.

L. Describe the multiple functions of wetlands.

M. Identify and describe the effects of natural and human events on watersheds and wetlands.

**Assessments/ Measurement of Objectives:**

* Review worksheets
* Homework activities
* Lab experiments
* Student projects / class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/Discussion
* “You solve it” The physical characteristics of a stream
* Mapping watersheds exercise
* “You solve it” Pennsylvania’s Mighty Susquehanna River
* “You solve It” Protecting PA’s wetlands
* Case Study: The 1999 summer drought. Short answer.
* “You solve it” Water Conservation.
* Water Quality Lab
* Macroinvetebrates Lab

**Unit 2: Renewable and Nonrenewable Resources**

**Estimated Time:** 1.5-2 weeks

**Standard Alignment:**

3.1.12A – Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.

3.1.12E - Evaluate change in nature, physical systems and man made systems.

3.2.12A – Evaluate the nature of scientific and technological knowledge.

3.5.12B – Analyze the availability, location and extraction of earth resources.

3.8.12C – Evaluate the consequences and impacts of scientific and technological solutions.

4.2.12A – Analyze the use of renewable and nonrenewable resources.

4.2.12B – Analyze factors affecting the availability of renewable and nonrenewable resources.

4.2.12C – Analyze factors that influence the availability of natural resources.

4.2.12D – Evaluate solid waste management practices.

**Curricular Objectives:**

A. Explain how renewable and nonrenewable resources supply energy and materials.

B. Compare and contrast various renewable and nonrenewable natural resources.

C. Identify and compare fuels used in developed and developing nations.

D. Identify alternative sources of energy.

E. Evaluate factors affecting availability of natural resources.

F. Describe natural events that may affect natural resources.

G. Analyze how human-made systems have impacted the management and distribution of natural resources.

H. Explain the different management alternatives involved in recycling and solid waste management.

I. Compare various methods of dealing with solid waste, including incineration, composting, and the use of landfills.

**Assessments/ Measurement of Objectives:**

* Review worksheets
* Homework activities
* Student projects / class assignments
* Research project *“New technologies in use, reuse, or recycling materials”*
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* “You Solve It” Electricity Generation in PA
* Case study questions: Natural Events Affect PA’s Forest Industry
* “You Solve It” The 3Rs-Reduce, Reuse, Recycle
* Active Reading Assignments: Renewable and Nonrenewable Resources
* Reading assignment worksheets

**Unit 3: Environmental Health**

**Estimated Time:** 2-2.5 weeks

**Standard Alignment:**

3.1.12E - Evaluate change in nature, physical systems and man made systems.

4.3.12A – Analyze the complexity of environmental health issues.

4.3.12B – Analyze the local, regional and national impacts of environmental health.

4.3.12C – Analyze the need for a healthy environment.

**Curricular Objectives:**

A. Identify the effects of air, water, and soil pollution on human health.

B. Explain how human practices affect the quality of the water and soil.

C. Describe how indoor pollutants might affect human health.

D. Explain the costs and benefits of cleaning up contaminants.

E. Identify various environmental regulations and their impacts on environmental health.

F. Explain how multiple variables determine the effects of pollution on environmental health, natural processes, and human practices.

G. Analyze data and explain how point source pollution can be detected and eliminated.

H. Identify and explain the state-of-the-art technologies used to detect pollution.

I. Identify evidence of natural events around the world that have affected environmental health.

J. Explain biological diversity as an indicator of a healthy environment.

K. Predict the effects of species extinction on the health of ecosystems.

**Assessments/ Measurement of Objectives:**

* Homework activities
* Student projects / class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* “You Solve It” Cleaning Up Around the House.
* Methyl Bromide Graphing Activity.
* Acid Rain Fingerprinting Lab.
* Water Analysis Lab.
* Case Study Questions: The Chesapeake Bay Program.
* “You Solve It” Natural Occurrences, Ecosystems, and Human Health.
* Active Reading Assignment: Biodiversity.
* Reading Assignments

**Unit 4: Integrated Pest Management**

**Estimated Time:** 1-1.5 weeks

**Standard Alignment:**

4.5.12A – Research integrated pest management systems.

4.5.12B – Research and analyze integrated pest management practices globally.

4.5.12C – Analyze the historical significance of integrated pest management on society.

**Curricular Objectives:**

A. Identify similar classifications of pests that may or may not have similar effects on different regions.

B. Identify environmental effects of pests on different regions around the world.

C. Identify introduced species that are classified as pests in their new environments.

D. Identify the health risks associated with chemicals used in common pesticides.

E. Identify the health benefits of the use of integrated pest management.

F. Determine the effects of integrated pest management practices on societies over time.

G. Analyze the risks to the environment and society associated with alternative practices used in integrated pest management.

H. Analyze the benefits to the environment and society associated with alternative practices used in integrated pest management.

**Assessments/ Measurement of Objectives:**

* Review worksheets
* Research projects
* Class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* “You Solve It” Organic Farming.
* Case study questions: Exotic Plants in PA.
* “You Solve It” Managing Pests in your Community
* Reading Assignments

**Unit 5: Ecosystems and Their Interactions**

**Estimated Time:** 2.5-3 weeks

**Standard Alignment:**

3.1.12A – Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.

3.1.12C – Assess and apply patterns in science and technology.

3.1.12E - Evaluate change in nature, physical systems and man made systems.

4.6.12A – Analyze the interdependence of an ecosystem.

4.6.12B – Analyze the impact of cycles on the ecosystem.

4.6.12C – Analyze how human action and natural changes affect the balance within an ecosystem.

**Curricular Objectives:**

A. Compare the interactions of biotic and a-biotic factors on specific ecosystems.

B. Analyze the effects of a-biotic factors on specific ecosystem.

C. Describe how the availability of resources affects organisms in an ecosystem.

E. Explain energy flow in a food chain through an energy pyramid.

F. Describe the various tropic levels that exist in different ecosystems.

G. Evaluate the efficiency of energy flow in a food chain.

H. Explain how erosion and sedimentation have changed the quality of soil habitats.

I. Explain the concept of carrying capacity in an ecosystem.

J. Identify the major biomes of the world and explain their similarities and differences.

H. Describe the element cycles and their roles in ecosystems.

I. Discuss the human impacts on natural cycles.

J. Explain how the greenhouse effect may lead to global warming.

K. Explain the importance of the ozone layer to life on the planet.

L. Discuss the various strategies to stop global warming and ozone destruction.

M. Differentiate between primary and secondary succession.

N. Discuss how humans can impact the stages of succession.

**Assessments/ Measurement of Objectives:**

* Review worksheets
* Homework activities
* Student projects / class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* “You Solve It” Pond Ecosystem
* “You Solve It” Nutrient Cycling in an Ecosystem.
* Case study: The East Side Project
* “You Solve It” Effects of Human Activities on Ecosystems.
* Active Reading Assignment: The Dynamic Earth.
* Active Reading Assignment: How Ecosystems Change.
* Reading assignment worksheets

**Unit 6: Population Dynamics**

**Estimated Time:** 2- 2.5 weeks

**Standard Alignment:**

4.6.12A – Analyze the interdependence of an ecosystem.

4.6.12C - Analyze how human action and natural changes affect the balance within an ecosystem.

4.7.12A – Analyze biological diversity as it relates to the stability of an ecosystem.

**Curricular Objectives:**

A. Describe the various population patterns.

B. Describe the factors that cause populations to increase in and decrease in size.

C. Explain the term carrying capacity as it relates to an ecosystem.

D. Examine various human populations using several population measurement techniques.

E. Describe the three types of survivorship curves.

F. Analyze population pyramids to predict the growth potential of various populations.

G. Describe the various techniques used to determine the actual or approximate size of a population.

H. Explain why populations need to be studied.

I. Identify several direct and indirect counting methods.

J. Use the mark and recapture method to estimate the size of a large population.

**Assessments/ Measurement of Objectives:**

* Review worksheets
* Homework activities
* Student project/class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* Lab: “So many people” and graphing activity
* Active Reading Assignment: How populations grow in size.
* Graphing Activity: Human Survivorship Curves
* Active Reading Assignment: Studying the Human Population.
* Population Explosion Lab
* Lab: Mark and Recapture
* Reading assignment worksheets

**Unit 7: Threatened, Endangered, and Extinct Species**

**Estimated Time:** 1.5-2 weeks

**Standard Alignment:**

4.7.12A – Analyze biological diversity as it relates to the stability of an ecosystem.

4.7.12B – Examine the effects of extinction, both natural and human caused, on the environment.

4.7.12C – Analyze the effects of threatened, endangered or extinct species on human and natural systems.

**Curricular Objectives:**

A. Explain the significance of diversity in ecosystems.

B. Explain the role that specific organisms have in their ecosystem.

C. Identify a species and explain what effects an increase or decrease in its population might have on an ecosystem.

D. Identify a species of concern and determine the role it plays in an ecosystem.

E. Define the three types of symbiotic relationships that exist between different species.

F. Explain how structure, function, and behavior of plants and animals affect their ability to survive.

G. Define the term niche and differentiate between the various niches that exist in an ecosystem.

H. Identify and explain why adaptations can lead to specialization.

I. Identify and explain criteria used by scientists for categorizing organisms as threatened, endangered, or extinct.

J. Describe the various laws that have been passed to protect endangered species.

**Assessments/ Measurement of Objectives:**

* Review worksheets
* Homework activities
* Student projects / class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* “You Solve It” Ecosystems and Species of Concern.
* Endangered species research project
* “You Solve It” The Endangered Indiana Bat
* Case study: Adaptations in the Ecosystem
* “You Solve It” Help for the Vulnerable Barn Owl
* Active Reading Assignment: Adaptation to Pollution
* Active Reading Assignment: How Ecosystems Change
* Reading assignment worksheets

**Unit 8: Humans and the Environment**

**Estimated Time:** 1- 1.5 weeks

**Standard Alignment:**

4.8.12A – Explain how technology has influenced the sustainability of natural resources over time.

4.8.12B – Analyze technology’s role on natural resource sustainability.

4.8.12C – Analyze how pollution has changed in quality, variety and toxicity as the United States developed its industrial base.

4.8.12D – Analyze the international implications of environmental occurrences.

**Curricular Objectives:**

A. Analyze how society’s needs relate to the sustainability of natural resources.

B. Compare and contrast the use of natural resources and the environmental conditions in several countries.

C. Describe how uses of natural resources impact sustainability.

D. Analyze the relationship between using natural resources and sustaining our society.

E. Analyze how human activities may cause changes in an ecosystem.

F. Compare and contrast the environmental effects of different industrial strategies such as energy generation, transportation, agriculture, etc.

G. Explain how the concept of supply and demand affects the environment.

H. Describe the relationship between population density and resource use and management.

I. Analyze technology’s role on the sustainability of natural resources.

J. Compare and contrast historical and current pollution levels.

K. Explain the international impact of environmental issues.

**Assessments/ Measurement of Objectives:**

* Review worksheets
* Homework activities
* Student projects / class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* “You Solve It” Sustainable Energy Use in PA.
* “You Solve It” Resource Shortages and Population.
* Case study: Solar Power in PA.
* “You Solve It” The Dangers of DDT.
* Case Study: Rachel Carson’s Legacy.
* “You Solve It” The Serpentine Aster: A Plant in Danger in PA.
* Active Reading Assignment: Humans and the environment.
* Active Reading Assignment: Sustainability
* Reading assignment worksheets

**Unit 9: Environmental Laws and Regulations**

**Estimated Time:** 1 week

**Standard Alignment:**

4.9.12A – Analyze environmental laws and regulations as they relate to environmental issues.

**Curricular Objectives:**

A. Explain why environmental laws and regulations are developed and enacted.

B. Analyze the roles that local, state, and federal governments play in the development and enforcement of environmental laws.

C. Explain the positive and negative impacts associated with passing environmental laws and regulations.

D. Understand rights of property owners and environmental laws and regulations.

E. Identify local and state environmental regulations and their impact on environmental health.

F. Explain the positive and negative impacts of the Endangered Species Act.

**Assessments/ Measurement of Objectives:**

* Review worksheets
* Homework activities
* Student projects / class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* “You Solve It” Enforcing the Endangered Species Act.
* Case study questions: Chesapeake 2000 Agreement.
* Active Reading Assignment: Humans and the Environment.
* Active Reading Assignment: Sustainability.
* Reading assignment worksheets

**Unit 10: Zoology**

**Estimated Time:** Taught throughout the semester – 2.5-4 weeks total time

**Standard Alignment:**

3.3.12A – Explain the relationship between structure and function at all levels of organization.

3.3.12B – Analyze the chemical and structural basis of living organisms.

**Curricular Objectives:**

1. Describe the biology and natural history of select Pennsylvania organisms.
2. Explain the ecological and economic importance of each organism.

**Assessments/ Measurement of Objectives:**

* Notes
* Class assignments
* Quizzes
* Test

**Suggested Methods of Instruction / Learning Activities:**

* Questioning/discussions
* Video Notes
* Dissections